them, and savour so strongly of the prairie or the river bank, that the lover of an outdoor life must be hard indeed to please if he cannot find matter of interest on almost any page to which he may happen to turn. The chapter-headings in some instances appear to be designed, at least to an English reader, to conceal rather than to elucidate the author's subjects, and we venture to think that some less recondite titles than "The Witchery of Wa-Wa" and "A Matter of Mascalouge" might have been selected without detriment to the picturesque style which the author apparently favours. But when once this little difficulty has been overcome, the reader will be able to find his way about the book, and select those sections in which he may be more specially interested.

The greater part of the book is devoted to fishing—both in sea and river—and feathered game shooting, and the English reader who desires to know the kind of sport afforded by ruffed grouse and "bob white" will find his requirements fully satisfied in the author's pages. Nor will the naturalist fail to find matter well worth his notice; and personally we have been specially interested in the account of the death-feigning instincts exhibited by the Carolina rail. Seemingly, when it thinks itself unable to escape, one of these birds suddenly "stiffens, topples over, and apparently expires. It may be taken up and examined for a considerable time without its betraying any signs of life. Place it among its dead fellows in the shooting-boat, and after a longer or shorter interval it may astonish its captor by either starting to run about, or by taking wing and fluttering away in the characteristic flight."

This is only one of many instances where strange habits of animals are recorded, and if not new they are always interesting and worth the re-telling. As a sample of the better class of sporting literature Mr. Sandys's work would be difficult to beat. R. L.

Ships and Shipping. By Commander R. Dowling. With a preface by Lieut. W. G. Ramsay Fairfax, R.N. Second Edition. Pp. xv+423. (London: A. Moring, Ltd., 1905.) Price 5*s.* net.

A VERY excellent little volume and a most handy addition to any shipping office. The naval information makes it also a very useful book to naval officers. One slight improvement would be useful—port-to-port distances round the coast of Great Britain and Europe; for example, London to Plymouth.

H. C. LOCKYER.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The late Sir John Burdon-Sanderson.

THE account of the life of Sir John Burdon-Sanderson in NATURE of December 7 is so admirable that any addition to it may seem superfluous. Yet, as one who knew Burdon-Sanderson for more than thirty-seven years, and who owed more to him than language can well express, I shall be grateful if you will allow me to say a few words more about him. It seems to me that in one respect men may be likened to mountains. The Matterhorn rises sharply to a single peak, and there can be no doubt as to its summit. Monte Rosa has more than one summit, so nearly on a level that a stranger would be unable to say which is highest, and although each is higher than the Matterhorn, the enormous bulk of the mountain takes away from their apparent height and makes them less imposing. In the same way it is easy to say what the great work has been of any man who has distinguished himself in a limited subject, but when a man's work ranges over a wide sphere it is not so easy. The account of Sir John Burdon-Sanderson's life in last week's NATURE clearly shows the wide extent of his activity and the great number of epoch-making discoveries which he made. If a scientific man were asked which of these is the greatest, he would probably answer according to his own personal bias. One man would name his unique researches on motion in plants; another his discovery of the possibility of attenuating anthrax virus and thus producing immunity from the disease; a third his researches on circulation and respiration; and a fourth his work on muscle and nerve. But all these things, important as they are, each one being sufficient to make a man famous in a special department, were only isolated outgrowths of his great work, and did not constitute it. I believe that I am right in saying that Burdon-Sanderson's life-work may be defined in three short sentences:—(1) He revolutionised physiology and pathology in this country; (2) he found them consisting of book-learning and microscopic observation; (3) he left them experimental sciences.

When he first constructed a kymographion in 1867 by the aid of a tin-plate worker near the Middlesex Hospital, to which he was then attached, there was not, with the exception of a few specimens of Marey's sphygmograph, a single recording physiological instrument in use in the whole of this country. Now they are to be found in every physiological laboratory, and every student knows how to use them. When he began to work at pathology, it consisted chiefly in descriptions of the naked-eye and microscopical appearances of specimens of morbid anatomy. Now the action of disease-germs and of toxins and the reaction of the organism to them, the processes of disease and not its results, engage the chief attention of pathologists, and the knowledge which experiments on these processes have afforded regarding the means of producing immunity and of curing by antitoxic sera has lessened, and is daily lessening, the wholesale destruction of life by epidemic diseases.

How Burdon-Sanderson accomplished his great work by his researches, by his writings, by his example, and by his personal influence was well described in last week's NATURE, but I may perhaps be permitted to mention my own case as an example of what Burdon-Sanderson did for young men. I came to London knowing only one man, who from age and infirmity was unable to help me; but fortunately for me I had a letter of introduction to Burdon-Sanderson. Instead of merely saying a few civil things and then leaving me alone, as he might well have done, he invited me to his house, advised me as to my career, obtained for me a lectureship in the Middlesex Hospital, to which he was then attached, gave me the free use of his laboratory, afforded me facilities for both experimental and literary work, and, in short, laid for me the foundation of any success I may since have had, so that it is mainly to him that I owe it. How many there are whom he has treated as he did me I do not know, for he did not let his left hand know the good his right hand was doing, but I do know that at least two others, Dr. Ferrier, who has done such splendid work in physiology, and Dr. Klein, who has done the same in pathology, owe, like me, their first establishment in London to Burdon-Sanderson. Such personal help as this in enabling young men to pursue a scientific career must not only be regarded as an evidence of the kindness and benevolence of his character, but must be reckoned along with his researches, his writings, his example, and his personal influence as a means whereby he accomplished his great work of revolutionising physiology and pathology in this country.

LAUDER BRUNTON.

Nomenclature of Kinship; its Extension.

THE method I adopted in your columns, August 11, 1904, of briefly expressing kinship has proved most convenient; it has been used in a forthcoming volume by Mr. E. Schuster and myself on "Noteworthy Families." I write now to show that it admits of being *particularised* by the use of foot-figures, as in the following example, which

refers to the more highly placed relatives of the newly elected King of Norway.

Haakon VII., King of Norway (*b.* 1872).

fa_{1s}	Frederick, Crown Prince of Denmark (*b.* 1843).
fa_{1s} *fa*	Christian IX., King of Denmark.
fa_{1s} bro_2	George I., King of the Hellenes (*b.* 1845).
fa_{1s} si_2	Dagmar, widow of Alexander III., Tsar of Russia, who *d.* 1894.
fa_{1s} si_2 son_1	Nicholas II., Tsar of Russia (*b.* 1868).
fa_{1s} si_1	Alexandra, Queen of England (*b.* 1844).
fa_{1s} si_1 son_1	George, Prince of Wales (*b.* 1865).
fa_{1s} si_1 da_3	also *wife*, Princess Maud (*b.* 1869) of England.

The formulæ are to be read thus:—"his (the K. of Norway's) father is the 1st (eldest) son, and is Frederick, C.P. of Denmark; "his (the K. of Norway's) father's father is Christian IX."; . . . "his father's 2nd sister's 1st son is Nicholas II."; . . . "his father's 1st sister's 3rd daughter, who is also his (the K. of Norway's) wife, is the Princess Maud." These foot-figures need not interfere with the simplicity of the general effect, while they enable a great deal of additional information to be included.

FRANCIS GALTON.

Atomic Disintegration and the Distribution of the Elements.

MR. DONALD MURRAY'S letter (p. 125) deals with a subject which I have been attempting, now for more than a year, to attack experimentally. A similar experience to that which Mr. Murray describes as the experience of a lifetime occurred to me eighteen months ago in a visit to the gold mines of Western Australia. Since then my thoughts have been less concerned with the radio-elements than with those like gold, platinum, thallium, indium, &c., which resemble radium in the minuteness and approximate constancy of the proportion in which they occur in nature.

It is wonderful to reflect that mankind for thousands of years has been passionately and determinedly engaged in the search for gold, not on account mainly of its useful qualities, but on account of its comparative scarcity. The history of gold-getting presents a strange uniformity. The search has been rewarded always with about the same qualified measure of success, never with such success that the value of gold has seriously depreciated. The common saying that about the same amount of gold has to be put into the earth in order to dig it out holds an economic and probably a scientific truth. For may we not consider that the history of these centuries of search, carried on with a tenacity of purpose and a continuity approached in the case of no other element, shows clearly that a natural law is here involved no less than in the case of radium or polonium? The history of gold-getting appears to be substantially the same in all countries in all times. We have the initial prospecting in which the chances and difficulties are so great that only the most adventurous attempt it; the discovery of surface gold and the rush from all parts of the earth; the phenomenal finds and the invariably much greater proportion of failure; the tracing of the gold to its source and the discovery of some cubic acres, or it may be miles, of gold-bearing earth. Then at first only the deposits averaging several ounces to the ton are thought worthy of attention; but these rapidly give out, and attention is directed to the poorer and still poorer veins, while at the same time the steady progress and evolution of the pioneer camp, where often gold seems to be commoner than water, into the civilised community served with railways, electric power, and often elaborate water supply, cheapens the cost of extraction to such an extent that deposits averaging only a few grains to the ton can be made to yield a profit. Finally, we have the same inevitable end when science and organisation have done all in their power, and the remaining ore contains just so much gold as *not* to pay.

Let the case be stated a little differently. What would be the effect of the sudden discovery in any one place of some really large quantity of gold? There seems no doubt that utter chaos would ensue in the commercial world, which might involve before it was got under control a rearrangement of the map of the world. Since nothing of the sort has ever happened, in spite of the most unprecedented struggles to that end, it is in accord with the principles of natural evolution to conclude that such a contingency probably violates some law of nature. Thus the gentlemen in charge of the national exchequer and of the Bank of England, who on a casual examination appear to be placing the most blind and implicit confidence on the future continuance of the existing order of things, are in reality secure in a fundamental if previously unrecognised law of nature. Eighteen months ago, after my visit to the gold deposits of Western Australia and New Zealand, and by the information which all concerned in the industry so readily placed at my disposal, I became convinced that in all probability gold, like radium, is at once the product of some other parent element, and is itself changing to produce "offspring" elements, so that its quantity, and hence its value, was fixed simply as the ratio of these two rates of change.

My experiments with gold have been both by the direct and indirect methods. The former have been dogged by misfortune and have so far been without result, while in the indirect experiments on ancient gold the results until now have been conflicting. Certainly some nuggets did not contain helium in appreciable quantities, while in others I did find a minute quantity of helium. This, however, was before the elaborate precautions afterwards employed had been adopted, and as I can now repeat the experiments with certainty as soon as occasion permits I am keeping a quite open mind. On the other hand, I have established to my own satisfaction that helium is an invariable constituent of native platinum in all the samples I have tried. The above reasoning, from rarity, after extended search, applies to platinum to a degree only less complete than in the case of gold.

The experiments with the other elements have not yet been proceeding long enough to have furnished results, but I have made a great many experiments with uranium and thorium in the attempt to detect directly the production of helium from these elements. These elements have been, in fact, the standards, for their rate of change is accurately known, and, assuming with Rutherford that the α particle is an atom of helium, may be expected to yield helium at a known rate. The methods of search have been perfected in the case of these two elements, and I am glad to be able to say that it is now only a question of time and patience before the rate at which helium is being produced from these two elements is accurately measured. On the other hand, if helium is not being produced, the experiments will indicate a maximum possible limit of the rate of production (set by the smallest quantity of helium detectable) far below the rate to be expected from theory. This method, which is, of course, applicable to any other element, would detect any other gas of the argon-helium family if produced. So far, however, I have only had one completely successful experiment with each element. In the case of uranium the result was positive, and indicated a rate of production of the same order as that required by theory. In the case of thorium, the experiment was of the nature of a blank test, and it proved that the rate of production is certainly not greater than ten times that required by theory.

Mr. Murray's letter induces me to put on record these imperfect results, and I do this the more readily as they may perhaps serve to emphasise and support his suggestion that experiments along the lines and on the scale he suggests should be carried out. But what laboratory in England could deal with ten tons of lead over a term of ten years?

After a year's work, I confess I am less hopeful than I was of the ability of the individual worker to carry out direct experiments in this subject of atomic disintegration. I wonder if the individual with his humble kilogram and his single lifetime is not starting on an almost forlorn hope, and is unduly and unnecessarily handicapped. Due consideration should be given to the supreme consequences that must follow from successful discoveries in this field. Not only is there to be considered the effect such results must exert on the whole trend of philosophic thought, but certain definite economic problems would be solved. For example, the proof of the disintegration of gold would reduce the doctrine of bimetallism and the theory of